SECTION 33 05 16

UTILITY STRUCTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Excavation and backfill.

A. Cast-in place concrete structures.

B. Precast concrete structures.

C. Metal components.

1.02 RELATED SECTIONS

A. Concrete formwork, concrete reinforcement, cast-in-place concrete, portland cement concrete, concrete repair and finishing, and precast concrete are specified in the various Sections under Division 3 - Concrete.

B. Interior trench drains and gratings for interior uses are specified in Section 05 50 00 - Metal Fabrication.

C. Ductbanks are specified in Section 20 50 16 - Underground Ductwork and Structures for Facility Services.

1.03 MEASUREMENT AND PAYMENT

A. General: Measurement and payment for utility structures will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for utility structures indicated in the Bid Schedule of the Bid Form.

B. Lump Sum: If the Bid Schedule indicates a lump sum for utility structures, the lump-sum method of measurement and payment will be in accordance with Section 01 20 00 - Price and Payment Procedures, Article 1.03.

C. Unit Price: If the Bid Schedule indicates a unit price for utility structures, the unit-price method of measurement and payment will be as follows:

1. Measurement:

a. Cast-in-place concrete and precast concrete units or structures and metal curb-and-gutter inlets will be measured for payment by the individual unit (each), installed in place. Each different type and size of concrete unit or structure will be measured separately for payment.

b. Manhole covers and frames, grates and frames, pipe inlets and outlets, manhole steps, ladders, miscellaneous metal, reinforcing steel, and grounding will not be measured separately for payment, but will be included as part of the utility structure to which it is attached or embedded.

c. Excavation and backfill for utility structures will be measured separately for payment as specified in Section 31 00 00 - Earthwork, as applicable.

2. Payment: Utility structures will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1, herein.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):

1.	ASTM A36/A36M	Specification for Structural Steel
2.	ASTM A48	Specification for Gray Iron Castings
3.	ASTM A108	Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
4.	ASTM A123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
5.	ASTM A153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
6.	ASTM A536	Specifications for Ductile Iron Castings
7.	ASTM B3	Specification for Soft or Annealed Copper Wire
8.	ASTM B26/B26M	Specification for Aluminum-Alloy Sand Castings
9.	ASTM C33	Specification for Concrete Aggregates
10.	ASTM C150	Specification for Portland Cement
11.	ASTM C260	Specification for Air-Entraining Admixtures for Concrete
12.	ASTM C270	Specification for Mortar for Unit Masonry
13.	ASTM C478	Specification for Precast Reinforced Concrete Manhole Sections
14.	ASTM C618	Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
15.	ASTM C789	Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
16.	ASTM C850	Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 feet of Cover Subjected to Highway Loadings

17. ASTM C858 Specification for Underground Precast Concrete Utility Structures

18. ASTM C891 Practice for Installation of Underground Precast Concrete Utility Structures

B. California Code of Regulations (CCR):

1. Title 24, Part 2, California Building Code, Chapter 21, Masonry, and State Chapter 21A, Masonry.

C. State of California, Department of Transportation (Caltrans):

1. Bridge Design Specifications Manual, Section 3, "Loads"

D Underwriters Laboratories Inc. (UL):

1. UL 467 Grounding and Bonding Equipment

1.05 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Shop Drawings: When not indicated on the Contract Drawings in sufficient detail or definition, submit detailed drawings of cast-in-place and precast concrete utility structures and related metal work.

C. Product Data: Submit manufacturers' product data for standard manufactured precast concrete utility boxes and structures and for metal gratings and covers and other, related miscellaneous metal items.

D. Certification: Submit certification or other acceptable evidence that covers and grates to be provided for roadways and parking areas meet proof-testing requirements for H2O and HS2O loadings in accordance with Caltrans Bridge Design Specifications Manual, Section 3.

PART 2 - PRODUCTS

2.01 CAST-IN-PLACE CONCRETE STRUCTURES

A. Materials: Comply with requirements of Section 03 05 15 - Portland Cement Concrete, except as specified otherwise herein.

1. Portland Cement: ASTM C150, Type II, low alkali.
2. Cementitious Admixture: Provide fly ash or pozzolan conforming with ASTM C618, Class F or N, not to exceed 15 percent by weight of the cement content.

3. Aggregates: ASTM C33, fine aggregate and Size Nos. 56 or 57 (1-inch maximum size) coarse aggregate.

B. Mix Design: Obtain design of concrete mix as specified in Section 03 05 15 - Portland Cement Concrete, and incorporate the following requirements:

1. Concrete Strength: Class 4000 minimum in accordance with Table 03305-A of Section 03 05 15 - Portland Cement Concrete, except that electrical structures, such as vaults, pull boxes, and concrete for ductbanks, shall be Class 3000.

2. Maximum water-cement plus pozzolan ratio: 0.45.

3. Maximum slump: 4 inches.

2.02 PRECAST CONCRETE STRUCTURES

A. General: The Contractor may provide precast concrete structures that conform to the general configuration, capacities, and inverts indicated.

B. Fabrication Standards: Comply with requirements of Section 03 40 00 - Precast Concrete, and ASTM C478, ASTM C789, ASTM C850, and ASTM C858, as applicable, and applicable manufacturers' standards.

C. Materials: Comply with requirements of Section 03 20 00 - Concrete Reinforcing, Section 03 05 15 - Portland Cement Concrete, and Section 03 40 00 - Precast Concrete, except as specified otherwise herein. Provide fine and coarse aggregates conforming to ASTM C33, in size commensurate with structure and reinforcement clearances.

D. Portland Cement Concrete: Class 4000 minimum in accordance with Table 03305-A of Section 03 05 15 - Portland Cement Concrete. Concrete may be polymer or latex modified to achieve higher strengths and denser concrete. Concrete shall not deteriorate from chemical attack of sanitary waste.

1. Concrete for electrical utility structures shall be Class 3000.

E. Precast Covers: Precast covers shall have the utility identification, such as "PG&E Gas Valve," stamped into the cover.

F. Quality Control: In accordance with Section 01 45 00 - Quality Control, the Contractor shall perform such inspections and tests as required to verify compliance with these Specifications.

2.03 METAL COVERS, GRATES, AND INLETS

A. Ferrous Castings:

1. Metal used in manufacture of castings shall conform to ASTM A48, Class 35B for Gray Iron, or ASTM A536, Grade 65-45-12 for Ductile Iron.

2. Castings shall be of uniform quality, free from blowholes, shrinkage, distortion or other defects. Castings shall be smooth and cleaned by shotblasting.

3. Minimum tensile strength shall be 35,000 psi.

4. Castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Round frames and covers shall have continuously machined bearing surfaces to prevent rocking and rattling.

5. Where castings will be subjected to loads of H2O or greater, as indicated, provide ductile iron castings.

B. Aluminum Castings: Where required to reduce weights of larger covers for ease of handling, such covers may be manufactured of aluminum castings conforming to ASTM B26/B26M, Alloy No. 713.0. Minimum tensile strength shall be 32,000 psi.

C. Manhole Covers: Provide cast, manufactured manhole covers and frames with heavy-duty solid cover (lid) or vented cover (lid) as indicated. Covers shall be embossed or engraved with nonslip diamond or square cross-hatched pattern. Provide covers with embossed or engraved word identification, as indicated or appropriate, for the enclosed or underground utility.

D. Grates:

1. Cast Ferrous Grates: Grates for area drains and catch basins shall be heavy-duty, bicycle-safe inlet grates and frames of size and configuration indicated. Grates in roadways and parking areas shall withstand H20 loadings when proof-tested in accordance with Caltrans Bridge Design Specifications Manual, Section 3.

2. Bar-Type Steel Grates: Refer to Section 05 50 00 - Metal Fabrications, for requirements. Bar-type steel gratings will be permitted only in areas where vehicular traffic will not be encountered.

E. Curb and Gutter Inlets: Provide cast, manufactured curb inlet frame, grate, and curb box of size and configuration indicated. Curb and gutter inlets shall conform to the contour and profile of the concrete curb and gutter. Grates shall be heavy-duty and bicycle-safe and shall withstand H20.

F. Cast Iron Manhole Steps: Provide cast, manufactured manhole steps with cross-hatched treads and with anchor configuration appropriate for cast-in-place concrete or precast concrete as indicated. Provide steps for installation 12 inches on center in vertical alignment.

2.04 MISCELLANEOUS METAL

A. Requirements: Provide channel inserts, pulling eyes, ladders, and electrical grounding rods for electrical manholes and pull boxes as indicated.

B. Steel Materials: Standard structural sections, shapes, plates, bars, and rods, as indicated, conforming with ASTM A36/A36M. Bars conforming with ASTM 108 will be acceptable.

C. Anchors and Bolts: Conform with requirements of Section 05 50 00 - Metal Fabrications, as applicable. Bolts and studs, nuts, and washers shall be hot-dip galvanized in accordance with ASTM A153.

D. Ladders: Provide standard-manufactured or custom-fabricated steel ladders as required to meet the conditions indicated. Steel ladders shall be hot-dip galvanized after fabrication.

E. Grounding and Bonding Materials: Conform with UL 467 and the following requirements:

1. Grounding Rods: Medium carbon steel core, copper-clad by the molten weld casting process, 3/4-inch diameter by 10 feet long in size.

2. Bare Conductors: ASTM B3, No. 1/0 AWG, Class B stranded, annealed copper conductor.

F. Fabrication: Form and fabricate the work as indicated. Include anchors, fasteners, and accessories to anchor and secure the work in place.

G. Galvanizing: All ferrous metal items shall be galvanized after fabrication by the hot-dip process in accordance with ASTM A123. Weight of the zinc coating shall conform with the requirements specified under "Weight of Coating" in ASTM A123.

2.05 MORTAR

A. Cement mortar for the sealing of openings for pipe penetrations, for cementing of joints of component parts of precast structures, for providing of flow characteristics for the bottoms of drainage structures, and other features as indicated shall conform with the California Building Code, Chapter 21, Type S (without lime), with a minimum compressive strength at 28 days of 1,800 psi.

B. Mortar shall comply with applicable requirements of ASTM C270, including measurement, mixing, proportioning, and water retention. Ten percent by volume of the cement content of the mortar shall be fly ash or pozzolanic material conforming with ASTM C618.

C. Use mortar within 90 minutes after mixing. Discard mortar that has been mixed longer or that has begun to set. Re-tempering of mortar will not be permitted.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Requirements: Construct manholes, junction chambers, catch basins, curb and gutter inlets, trench drains, culverts, headwalls, wingwalls, pull boxes, utility boxes and vaults, and related utility structures in connection with the installation of pipe, conduits, ductbanks, and utility trenches, as indicated.

B. Excavation and Backfill: Provide excavation, prepared subgrade and aggregate base, and backfill as specified in Section 31 00 00 - Earthwork, Section 33 05 28 - Trenching and Backfilling for Utilities, Section 32 11 17 - Aggregate Subbase Courses, and Section 32 11 23 - Aggregate Base Course, as indicated.

C. Cast-in-Place Concrete Structures: Provide formwork, steel reinforcement, and concrete in accordance with applicable requirements of Section 03 11 00 - Concrete Forming, Section 03 20 00 - Concrete Reinforcing, and Section 03 30 00 - Cast-In-Place Concrete.

D. Precast Concrete Structures: Install as indicated. Comply with applicable requirements of ASTM C891. Provide such appurtenances and installation accessories, including cement mortar and sealants, as required for a complete installation.

E. Metal Components: Install manhole covers, grates and frames, curb and gutter inlets, metal steps, ladders, channel inserts, pulling eyes, and electrical grounding rods as indicated and in accordance with the respective manufacturer's instructions. Covers and grates in roadways, parking areas, and concrete walks shall be installed flush with adjacent, abutting pavement.

3.02 FIELD QUALITY CONTROL

A. The Contractor shall perform slump tests and strength tests of cast-in-place structures in accordance with the requirements specified in Section 03 05 15 - Portland Cement Concrete.

B. Acceptance of cast-in-place structures will be in accordance with Section 03 05 15, Portland Cement Concrete.

END OF SECTION 33 05 16